CHAPTER 2

Ethernet Switching Modules

This chapter describes the 10BASE, 10/100BASE, 10/100/1000BASE, 1-Gigabit, and the 10-Gigabit Ethernet modules and contains these sections:

- 10 and 10/100 Fiber-Based Ethernet Modules, page 2-1
- 10/100 and 10/100/1000 Ethernet Modules, page 2-10
- 1-Gigabit Ethernet Modules, page 2-49
- 10-Gigabit Ethernet Modules, page 2-66

Note Service modules are not covered in this document. They have their own standalone documentation sets.

10 and 10/100 Fiber-Based Ethernet Modules

This section describes the following 10 and 10/100 fiber-based Ethernet modules:

- WS-X6024-10FL-MT Ethernet Module, page 2-2
- WS-X6148-FE-SFP Ethernet Module, page 2-4
- WS-X6324-100FX-MM and WS-X6324-100FX-SM Ethernet Modules, page 2-6
- WS-X6524-100FX-MM Ethernet Module, page 2-8

WS-X6024-10FL-MT Ethernet Module

The WS-X6024-10FL-MT Ethernet module (Figure 2-1) provides 24 10-Mbps full- or half-duplex ports. Table 2-1 lists the module features, and Table 2-2 lists the module physical and environmental specifications.

Figure 2-1 WS-X6024-10FL-MT Ethernet Module Front Panel

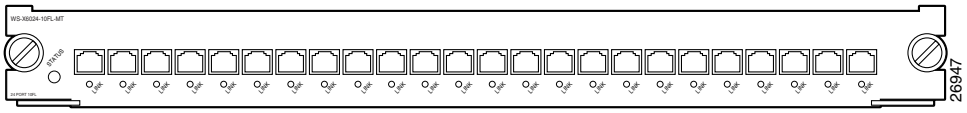


Table 2-1 WS-X6024-10FL-MT Ethernet Module Features

Feature	Description
Ports per module	24
Connector type	MT-RJ
Cabling distance	1.24 mi (2 km) full- or half-duplex over 62.5- and 125-micron MMF
Speed	10-Mbps
Buffer size	64 KB per port
Maximum frame size	Up to 9216 bytes per frame
Supervisor engine support	Supported by the following supervisor engines: • Supervisor Engine 2 • Supervisor Engine 32 • Supervisor Engine 720
Queues per port	• Tx—2q2t • Rx—1q4t
Chassis/slot restrictions	No chassis or slot restrictions; the module can occupy any slot in any Catalyst 6500 or Catalyst 6500-E chassis.
Bus connection	Single connection into the 32-Gbps shared bus
Module upgrades available	
PoE support	Not available.
Distributed forwarding support	Not available.
Pluggable transceivers support	Not supported.

Table 2-1 WS-X6024-10FL-MT Ethernet Module Features (continued)

Feature	Description
Digital Optical Monitoring (DOM) support	Not supported
Module front panel LEDs	**STATUS** • Green—All diagnostics pass; the module is operational. • Orange—The module is booting or running diagnostics; an overtemperature condition has occurred. **LINK** • Green—The port is active (the link is connected and operational). • Flashing orange—The port failed diagnostics and is disabled. • Orange—The port is disabled. • Red—The module is resetting; an overtemperature condition has occurred. **Note** If the module fails to download code and configuration information successfully during the initial reset, the LED stays red; the module does not come online. • Off—The port is not active or the link is not connected.

Table 2-2 WS-X6024-10FL-MT Ethernet Module Physical and Environmental Specifications

Item	Specification
Dimensions (H x W x D)	1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm). Occupies one slot in the chassis.
Weight	7.0 lb (3.18 kg)
Power requirement (at 42 VDC)	1.52 A
Environment	
Operating temperature	• Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (noncondensing)	10 to 90%
Operating altitude	• Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)

WS-X6148-FE-SFP Ethernet Module

The WS-X6148-FE-SFP Ethernet module (Figure 2-2) provides 48 100-Mbps full- or half-duplex ports. Table 2-3 lists the module features, and Table 2-4 lists the module physical and environmental specifications.

Figure 2-2 WS-X6148-FE-SP Ethernet Module Front Panel

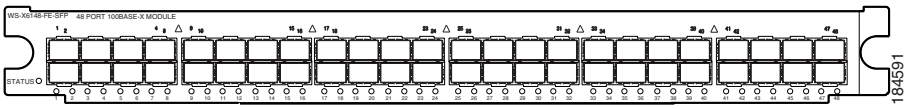


Table 2-3 WS-X6148-FE-SFP Features

Feature	Description
Ports per module	48
Connector type	LC or RJ-45 (depending on the type of 100-Mbps Fast Ethernet SFP transceiver installed)
Cabling distance	Depends on the 100BASE-X Fast Ethernet SFP transceiver installed in the module port. Refer to Appendix B for descriptions of the Fast Ethernet SFP transceiver types and supported cabling distances.
Speed	100 Mbps
Buffer size	256 MB shared between 48 ports (5.4 MB per port)
Maximum frame size	Up to 9216 bytes per frame
Supervisor engine support	Supported on the following supervisor engines: • Supervisor Engine 2 • Supervisor Engine 32 • Supervisor Engine 720
Queues per port	• Tx—1p3q8t (per port) • Rx—1p1q2t (per group of 8 ports)
Chassis/slot restrictions	No chassis or slot restrictions; the module can occupy any slot in any Catalyst 6500 or Catalyst 6500-E chassis.
Bus connection	Single connection into the 32-Gbps shared bus
Module upgrades available	
PoE support	Not available.
Distributed forwarding support	Not available.
Pluggable transceivers support	The module supports 100BASE-X Fast Ethernet SFP transceivers. Refer to your software release notes to determine which Fast Ethernet SFP transceivers are supported. See Appendix B for additional information on the Fast Ethernet SFP transceivers.

Table 2-3 WS-X6148-FE-SFP Features (continued)

Feature	Description
Digital Optical Monitoring (DOM) support	Not supported
Module front panel LEDs	**STATUS** • Green—All diagnostics pass; the module is operational. • Orange—The module is booting or running diagnostics; an overtemperature condition has occurred. **LINK** • Green—The port is active (the link is connected and operational). • Flashing orange—The port failed diagnostics and is disabled. • Orange—The port is disabled. • Red—The module is resetting; an overtemperature condition has occurred. **Note** If the module fails to download code and configuration information successfully during the initial reset, the LED stays red; the module does not come online. • Off—The port is not active or the link is not connected.

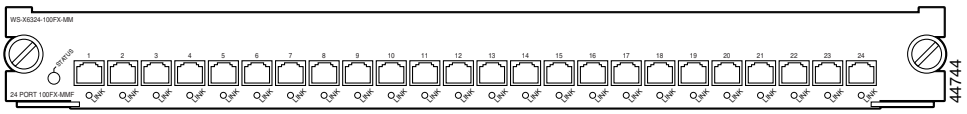
Table 2-4 WS-X6148-FE-SFP Physical and Environmental Specifications

Item	Specification
Dimensions (H x W x D)	1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm). Occupies one slot in the chassis.
Weight	6.6 lb (3 kg)
Power requirement (at 42 VDC)	2.3 A
Environment	
Operating temperature	• Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (noncondensing)	10 to 90%
Operating altitude	• Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)

WS-X6324-100FX-MM and WS-X6324-100FX-SM Ethernet Modules

The WS-X6324-100FX-MM and the WS-X6324-100FX-SM Ethernet modules (Figure 2-3) provide 24 100-Mbps full- or half-duplex ports. The WS-X6324-100FX-MM Ethernet module operates over multimode fiber-optic (MMF) cable and the WS-X6324-100FX-SM Ethernet module operates over G.652 single-mode fiber-optic (SMF) cable. Table 2-5 lists both modules features, and Table 2-6 lists both modules physical and environmental specifications.

Figure 2-3 WS-X6324-100FX-MM and WS-X6324-100FX-SM Ethernet Modules Front Panel



Note The WS-X6324-100FX-SM Ethernet module front panel is identical to the WS-X6324-100FX-MM Ethernet module front panel with the exception of the product part number.

Table 2-5 WS-X6324-100FX-MM and WS-X6324-100FX-SM Ethernet Module Features

Feature	Description
Ports per module	24
Connector type	MT-RJ (both modules)
Cabling distance	• WS-X6324-100FX-MM—1.24 mi (2 km) full-duplex over MMF • WS-X6324-100FX-MM—1312 ft (400 m) half-duplex over MMF • WS-X6324-100FX-SM—6.2 mi (10 km) full- or half-duplex over G.652 SMF
Speed	100 Mbps
Buffer size	128 KB per port
Maximum frame size	Up to 9216 bytes per frame
Supervisor engine support	Supported by the following supervisor engines: • Supervisor Engine 2 • Supervisor Engine 32 • Supervisor Engine 720
Queues per port	Both modules: • Tx—2q2t • Rx—1q4t
Chassis/slot restrictions	No chassis or slot restrictions; the modules can occupy any slot in any Catalyst 6500 or Catalyst 6500-E chassis.
Bus connection	Single connection into the 32-Gbps shared bus

Table 2-5 WS-X6324-100FX-MM and WS-X6324-100FX-SM Ethernet Module Features (continued)

Feature	Description
Module upgrades available	
PoE support	Not available.
Distributed forwarding support	Not available.
Pluggable transceivers support	Not supported.
Digital Optical Monitoring (DOM) support	Not supported.
Module front panel LEDs	**STATUS** • Green—All diagnostics pass; the module is operational. • Orange—The module is booting or running diagnostics; an overtemperature condition has occurred. **LINK** • Green—The port is active (the link is connected and operational). • Flashing orange—The port failed diagnostics and is disabled. • Orange—The port is disabled. • Red—The module is resetting; an overtemperature condition has occurred. **Note** If the module fails to download code and configuration information successfully during the initial reset, the LED stays red; the module does not come online. • Off—The port is not active or the link is not connected.

Table 2-6 WS-X6324-100FX-MM and WS-X6324-100FX-SM Ethernet Modules Physical and Environmental Specifications

Item	Specification
Dimensions (H x W x D)	1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm). Occupies one slot in the chassis.
Weight	7.0 lb (3.18 kg)
Power requirement (at 42 VDC)	1.52 A (both modules)
Environment	
Operating temperature	• Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (noncondensing)	10 to 90%
Operating altitude	• Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)

WS-X6524-100FX-MM Ethernet Module

The WS-X6524-100FX-MM Ethernet module (Figure 2-4) provides 24 100-Mbps full- or half-duplex ports. Table 2-7 lists the module features, and Table 2-8 lists the module physical and environmental specifications.

Figure 2-4 WS-X6524-100FX-MM Switching Modules Front Panel

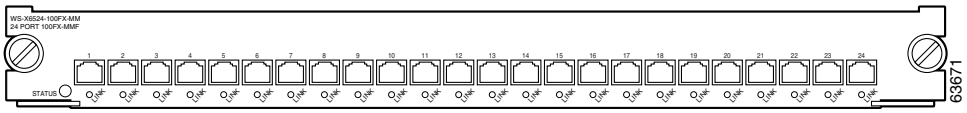


Table 2-7 WS-X6524-100FX-MM Features

Feature	Description
Ports per module	24
Connector type	MT-RJ
Cabling distance	1.24 mi (2 km) full-duplex; 1312 ft (400 m) half-duplex over MMF
Speed	100 Mbps
Buffer size	1.2 MB per port
Maximum frame size	Up to 9216 bytes per frame
Supervisor engine support	Supported by the following supervisor engines: • Supervisor Engine 2 • Supervisor Engine 32 • Supervisor Engine 720
Queues per port	• Tx—1p3q1t • Rx—1p1q0t
Chassis/slot restrictions	No chassis or slot restrictions; the module can occupy any slot in any Catalyst 6500 or Catalyst 6500-E chassis.
Bus connection	Single connection into the 32-Gbps shared bus

Table 2-7 WS-X6524-100FX-MM Features (continued)

Feature	Description
Module upgrades available	
PoE support	Not available
Distributed forwarding support	Field upgradeable to support distributed forwarding with the following daughter cards: • WS-F6K-DFC • WS-F6K-DFC3A • WS-F6K-DFC3B • WS-F6K-DFC3BXL See Appendix A for further information on the DFC daughter cards. See the *Catalyst 6500 Series DFC, DFC3A, DFC3B, and DFC3BXL Installation Note* for field installation procedures.
Pluggable transceivers support	Not supported
Digital Optical Monitoring (DOM) support	Not supported
Module front panel LEDs	**STATUS** • Green—All diagnostics pass; the module is operational. • Orange—The module is booting or running diagnostics; an overtemperature condition has occurred. **LINK** • Green—The port is active (the link is connected and operational). • Flashing orange—The port failed diagnostics and is disabled. • Orange—The port is disabled. • Red—The module is resetting; an overtemperature condition has occurred. **Note** If the module fails to download code and configuration information successfully during the initial reset, the LED stays red; the module does not come online. • Off—The port is not active or the link is not connected.

Table 2-8 WS-X6524-100FX-MM Physical and Environmental Specifications

Item	Specification
Dimensions	1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm). Occupies one slot in the chassis.
Weight	Base module—7.0 lb (3.18 kg)
Power required (at 42 VDC)	• Base module—1.90 A • Base module + DFC3 daughter card (WS-F6K-DFC3)—4.00 A • Base module + DFC3A daughter card (WS-F6K-DFC3A)—4.47 A • Base module + DFC3B daughter card (WS-F6K-DFC3B)—3.57 A • Base module + DFC3BXL daughter card (WS-F6K-DFC3BXL)—3.37 A
Environment	
Operating temperature	• Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (noncondensing)	10 to 90%
Operating altitude	• Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)

10/100 and 10/100/1000 Ethernet Modules

This section describes the following 10/100 and 10/100/1000BASE Ethernet modules:

- WS-X6148-GE-TX and WS-X6148A-GE-TX Ethernet Modules, page 2-11
- WS-X6148-RJ21 Ethernet Modules, page 2-15
- WS-X6148-RJ-45 and WS-X6148A-RJ-45 Ethernet Modules, page 2-18
- WS-X6148X2-RJ-45 and WS-X6148X2-45AF Ethernet Modules, page 2-22
- WS-X6196-RJ-21 and WS-X6196-21AF Ethernet Modules, page 2-26
- WS-X6348-RJ21V Ethernet Module, page 2-29
- WS-X6348-RJ45 and WS-X6348-RJ45V Ethernet Modules, page 2-32
- WS-X6516-GE-TX Ethernet Module, page 2-35
- WS-X6548-GE-TX, WS-X6548-GE-45AF, and WS-X6548V-GE-TX Ethernet Modules, page 2-38
- WS-X6548-RJ-21 Ethernet Module, page 2-41
- WS-X6548-RJ-45 Ethernet Module, page 2-44
- WS-X6748-GE-TX Ethernet Module, page 2-47

WS-X6148-GE-TX and WS-X6148A-GE-TX Ethernet Modules

The base WS-X6148-GE-TX and the base WS-X6148A-GE-TX Ethernet modules and their variants, listed in Table 2-9, provide 48 10/100/1000-Mbps full- or half-duplex ports. Figure 2-5 shows the module front panel.

Table 2-9 WS-X6148-GE-TX and WS-X6148A-GE-TX Ethernet Module Variants

Module	Description
WS-X6148-GE-TX	Base module without daughter cards installed.
WS-X6148-GE-45AF	Base module equipped with a factory-installed IEEE 802.3af PoE daughter card (WS-F6K-GE48-AF).
WS-X6148V-GE-TX	Base module equipped with a factory-installed Cisco prestandard PoE daughter card (WS-F6K-VPWR-GE).
WS-X6148A-GE-TX	Base module (with enhanced port buffer size) without daughter cards installed.
WS-X6148A-GE-45AF	Base module (with enhanced port buffer size) equipped with a factory-installed IEEE 802.3af PoE daughter card (WS-F6K-GE48-AF).

Figure 2-5 WS-X6148-GE-TX Ethernet Module Front Panel

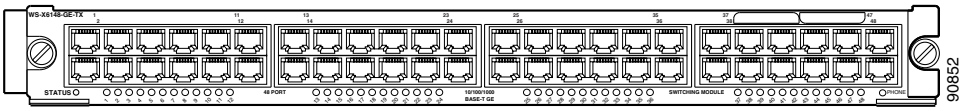


Table 2-10 lists the features and descriptions for the base modules and their variants, and Table 2-11 lists the physical and environmental specifications for the base modules and their variants.

Note The WS-X6148-GE-TX and the WS-X6148A-GE-TX Ethernet modules share the same front panel. The product numbers located in the upper-left corner will differ.

Table 2-10 WS-X6148-GE-TX Features

Feature	Description
Ports per module	48 ports (all variants)
Connector type	RJ-45 (all variants)
Cabling distance	328 ft (100 m) over Category 5, 5e, and 6 UTP/STP cable (all variants)
Speed	10/100/1000 IEEE 802.3 triple-speed autonegotiation (all variants)
Buffer size	• WS-X6148-GE-TX, WS-X6148V-GE-TX, and WS-X6148-GE-45AF—1.4 MB per 8 ports • WS-X6148A-GE-TX and WS-X6148A-GE-45AF—5.5 MB per port

Table 2-10 WS-X6148-GE-TX Features (continued)

Feature	Description
Maximum frame size	• WS-X6148-GE-TX, WS-X6148V-GE-TX, and WS-X6148-GE-45AF—Up to 1518 bytes per frame • WS-X6148A-GE-TX and WS-X6148A-GE-45AF—Up to 9216 bytes per frame
Supervisor engine support	Supported by the following supervisor engines: • Supervisor Engine 2 • Supervisor Engine 32 • Supervisor Engine 720
Queues per port	WS-X6148-GE-TX, WS-X6148V-GE-TX, and WS-X6148-GE-45AF: • Tx—1p2q2t (per 8 ports) • Rx—1p2t (per port) WS-X6148A-GE-TX and WS-X6148A-GE-45AF: • Tx—1p3q8t • Rx—1q2t
Chassis/slot restrictions	No chassis or slot restrictions: the module can occupy any slot in any Catalyst 6500 or Catalyst 6500-E chassis (all variants)
Bus connection	Single connection into the 32-Gbps shared bus (all variants).
Module upgrades available	
PoE support	WS-X6148-GE-TX and WS-X6148A-GE-TX: • The WS-X6148-GE-TX is field upgradeable with the WS-F6K-VPWR-GE= daughter card that supports only the Cisco prestandard. • Both the WS-X6148-GE-TX and the WS-X6148A-GE-TX are field upgradeable with the WS-F6K-GE48-AF= daughter card that supports both the Cisco prestandard and the IEEE 802.3af standard. Refer to the *Catalyst 6500 Series Power over Ethernet Daughter Cards Field-Upgrade Installation Note* for field upgrade procedures. Refer to Appendix A for additional information on the PoE daughter cards.
Distributed forwarding support	Not supported.

Table 2-10 WS-X6148-GE-TX Features (continued)

Feature	Description
Pluggable transceivers support	Not supported.
TDR support	All variants are supported.
Module front panel LEDs	**STATUS** • Green—All diagnostics pass; the module is operational. • Orange—The module is booting or running diagnostics; an overtemperature condition has occurred. **LINK** • Green—The port is active (the link is connected and operational). • Flashing orange—The port failed diagnostics and is disabled. • Orange—The port is disabled. • Red—The module is resetting; an overtemperature condition has occurred. **Note** If the module fails to download code and configuration information successfully during the initial reset, the LED stays red; the module does not come online. • Off—The port is not active or the link is not connected. **PHONE** • Green—The PoE daughter card is installed and detected. • Off—The PoE daughter card is not detected or is not installed.

Table 2-11 WS-X6148-GE-TX and Variants Specifications

Item	Specification
Dimensions (H x W x D)	1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm). Occupies one slot in the chassis.
Weight	• WS-X6148-GE-TX (base module only)—7.6 lb (3.4 kg) • WS-X6148A-GE-TX (base module only)—6.6 lb (3 kg)
Power requirement (at 42 VDC)	• WS-X6148-GE-TX (base module)—2.47 A • WS-X6148-GE-45AF (base module + PoE daughter card)—2.65 A • WS-X6148V-GE-TX (base module + PoE daughter card)—2.89 A • WS-X6148A-GE-TX (enhanced base module)—2.50 A • WS-X6148A-GE-45AF (enhanced base module + PoE daughter card)—2.68 A
Environment	
Operating temperature	• Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (noncondensing)	10 to 90%
Operating altitude	• Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)

WS-X6148-RJ21 Ethernet Modules

The WS-X6148-RJ21 Ethernet module and its two variants, listed in Table 2-12, provide 48 10/100/1000-Mbps full- or half-duplex ports. Figure 2-6 shows the module front panel.

Table 2-12 WS-X6148-RJ21 Ethernet Module Variants

Module	Description
WS-X6148-RJ21	Base module without daughter cards installed.
WS-X6148-21AF	Base module equipped with a factory-installed IEEE 802.3af PoE daughter card (WS-F6K-GE48-AF).
WS-X6148-RJ21V	Base module equipped with a factory-installed Cisco prestandard PoE daughter card (WS-F6K-VPWR-GE).

Figure 2-6 WS-X6148-RJ-21 Ethernet Module Front Panel

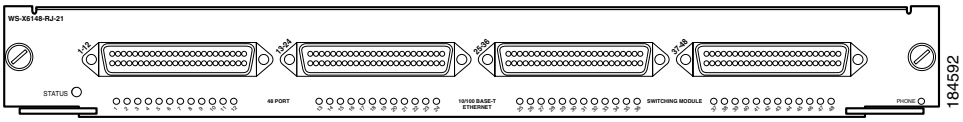


Table 2-13 lists the features and descriptions for the modules, and Table 2-14 lists the physical and environmental specifications for the modules.

Table 2-13 WS-X6148-RJ-21 Ethernet Modules Features

Feature	Description
Ports per module	48 ports (all variants)
Connector type	RJ-21 (all variants)
Cabling distance	328 ft (100 m) over Category 5, 5e, and 6 UTP/STP cable (all variants)
Speed	10/100/1000 IEEE 802.3 triple-speed autonegotiation (all variants)
Buffer size	128 KB per port (all variants)
Maximum frame size	Up to 8092 bytes per frame (all variants)
Supervisor engine support	Supported by the following supervisor engines: • Supervisor Engine 2 • Supervisor Engine 32 • Supervisor Engine 720
Queues per port	All variants: • Tx—2q2t • Rx—1q4t

Table 2-13 WS-X6148-RJ-21 Ethernet Modules Features (continued)

Feature	Description
Chassis/slot restrictions	No chassis or slot restrictions; the module can occupy any slot in any Catalyst 6500 or Catalyst 6500-E chassis (all variants).
Bus connection	Single connection into the 32-Gbps shared bus (all variants)
Daughter card support	
PoE support	WS-X6148-RJ-21—Field upgradeable to Cisco Prestandard only by installing the WS-F6K-VPWR= daughter card. Refer to the *Cisco Catalyst 6500 Series Power over Ethernet Daughter Cards Field-Upgrade Installation Note* for field upgrade procedures. **Note** An IEEE 802.3af standard PoE daughter card is available through factory advance replacement only; the IEEE 802.3af standard PoE daughter card is not field upgradeable.
Distributed forwarding support	Not available.
Pluggable transceivers support	Not supported.
TDR support	All variants supported.
Module front panel LEDs	**STATUS** • Green—All diagnostics pass; the module is operational. • Orange—The module is booting or running diagnostics; an overtemperature condition has occurred. **LINK** • Green—The port is active (the link is connected and operational). • Flashing orange—The port failed diagnostics and is disabled. • Orange—The port is disabled. • Red—The module is resetting; an overtemperature condition has occurred. **Note** If the module fails to download code and configuration information successfully during the initial reset, the LED stays red; the module does not come online. • Off—The port is not active or the link is not connected. **PHONE** • Green—The PoE daughter card is installed and detected. • Off—The PoE daughter card is not detected or is not installed.

Table 2-14 WS-X6148-RJ-21 Specifications

Item	Specification
Dimensions (H x W x D)	1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm). Occupies one slot in the chassis.
Weight	• Base module only—8.0 lb (3.6 kg)
Power requirement (at 42 VDC)	• WS-X6148-RJ-21 (base module)—2.39 A • WS-X6148-21AF (base module + PoE daughter card)—2.57 A • WS-X6148-RJ21V (base module + PoE daughter card)—2.81 A
Environment	
Operating temperature	• Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (noncondensing)	10 to 90%
Operating altitude	• Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)

WS-X6148-RJ-45 and WS-X6148A-RJ-45 Ethernet Modules

The WS-X6148-RJ-45 and the WS-X6148A-RJ-45 Ethernet modules provide 48 10/100/1000-Mbps full- or half-duplex ports. Table 2-15 lists the two base modules and their variants. Figure 2-7 shows the module front panel.

Table 2-15 WS-X6148-RJ-45 and WS-X61248A-RJ-45 Ethernet Modules and Variants

Module	Description
WS-X6148-RJ-45	Base module without daughter cards installed.
WS-X6148-45AF	Base module equipped with a factory-installed IEEE 802.3af PoE daughter card (WS-F6K-GE48-AF).
WS-X6148-RJ45V	Base module equipped with a factory-installed Cisco prestandard PoE daughter card (WS-F6K-VPWR-GE).
WS-X6148A-RJ-45	Base module (with enhanced port buffer size) without daughter cards installed.
WS-X6148A-45AF	Base module (with enhanced port buffer size) equipped with a factory-installed IEEE 802.3af PoE daughter card (WS-F6K-GE48-AF).

Figure 2-7 WS-X6148-RJ-45 Ethernet Module Front Panel

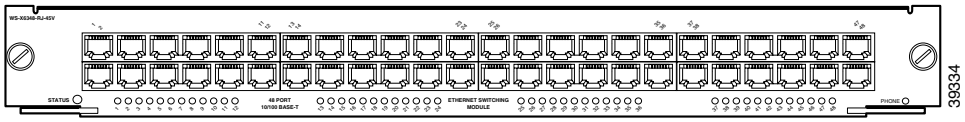


Table 2-16 lists the features and descriptions for the modules, and Table 2-17 lists the physical and environmental specifications for the modules.

Note The WS-X6148-RJ-45 and the WS-X6148A-RJ-45 Ethernet modules share the same front panel. The product numbers in the upper-left corner will differ.

Table 2-16 WS-X6148-RJ-45 and WS-X6148A-RJ-45 Ethernet Modules Features

Feature	Description
Ports per module	48 ports (all variants)
Connector type	RJ-45 (all variants)
Cabling distance	328 ft (100 m) over Category 5, 5e, and 6 UTP/STP cable (all variants)
Speed	10/100/1000 IEEE 802.3 triple-speed autonegotiation (all variants)

Table 2-16 WS-X6148-RJ-45 and WS-X6148A-RJ-45 Ethernet Modules Features (continued)

Feature	Description
Buffer size	• WS-X6148-RJ-45, WS-X6148-45AF, and WS-X6148-RJ45V—1 MB per 8 ports • WS-X6148A-RJ-45 and WS-X6148A-45AF—5.3 MB per 8 ports
Maximum frame size	• WS-X6148-RJ-45, WS-X6148-45AF, and WS-X6148-RJ45V—Up to 8092 bytes per frame • WS-X6148A-RJ-45 and WS-X6148A-45AF—Up to 9216 bytes per frame
Supervisor engine support	Supported on the following supervisor engines: • Supervisor Engine 2 • Supervisor Engine 32 • Supervisor Engine 720
Queues per port	WS-X6148-RJ-45, WS-X6148-45AF, and WS-X6148-RJ45V: • Tx—1p2q2t per 8 ports • Rx—1p2t per port WS-X6148A-RJ-45 and WS-X6148A-45AF: • Tx—1p3q8t • Rx—1q2t
Chassis/slot restrictions	No chassis or slot restrictions; the module can occupy any slot in any Catalyst 6500 or Catalyst 6500-E chassis (all variants).
Bus connection	Single connection into the 32-Gbps shared bus (all variants)
Module upgrades available	
PoE support	• WS-X6148-RJ-45—Field upgradeable to the Cisco prestandard only with the WS-F6K-VPWR-GE= daughter card or both the Cisco prestandard and the IEEE 802.3af standard by installing the WS-F6K-GE48-AF= daughter card. • WS-X6148A-RJ-45—Field upgradeable to the Cisco prestandard and the IEEE 802.3af standard by installing the WS-F6K-GE48-AF= daughter card. See the *Cisco Catalyst 6500 Series Power over Ethernet Daughter Cards Field-Upgrade Installation Note* for field upgrade procedures. See Appendix A for further information on the PoE daughter cards.
Distributed forwarding support	Not supported.

Table 2-16 WS-X6148-RJ-45 and WS-X6148A-RJ-45 Ethernet Modules Features (continued)

Feature	Description
Pluggable transceivers support	Not supported.
TDR support	Yes
Module front panel LEDs	**STATUS** • Green—All diagnostics pass; the module is operational. • Orange—The module is booting or running diagnostics. An overtemperature condition has occurred. (A minor temperature threshold has been exceeded during environmental monitoring.) • Red—The module is resetting. The switch has just been powered on or the module has been hot inserted during the normal initialization sequence. An overtemperature condition has occurred. (A major temperature threshold has been exceeded during environmental monitoring.) If the module fails to download code and configuration information successfully during the initial reset, the LED stays red; the module does not come online. **LINK** • Green—The port is active (the link is connected and operational). • Orange—The module or port is disabled through the CLI command or the module is initializing. • Flashing orange—The port is faulty and has been disabled. • Off—The port is not active or the link is not connected. **PHONE** • Green—The PoE daughter card is installed and detected. • Off—The PoE daughter card is not detected or is not installed.

Table 2-17 WS-X6148-RJ-45 Ethernet Modules Specifications

Item	Specification
Dimensions (H x W x D)	1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm). Occupies one slot in the chassis.
Weight	• WS-X6148-RJ-45 (Base module)—6.8 lb (3.08 kg) • WS-X6148A-RJ-45 (Enhanced base module)—7.2 lb (3.27 kg)
Power requirement (at 42 VDC)	• WS-X6148-RJ-45—2.39 A • WS-X6148-45AF (base module + PoE daughter card) —2.57 A • WS-X6148-RJ45V (base module + PoE daughter card)—2.81 A • WS-X6148A-RJ-45—1.00 A • WS-X6148A-RJ45AF (enhanced base module + PoE daughter card)—1.18 A
Environment	
Operating temperature	• Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (noncondensing)	10 to 90%
Operating altitude	• Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)

WS-X6148X2-RJ-45 and WS-X6148X2-45AF Ethernet Modules

The WS-X6148X2-RJ-45 and the WS-X6148X2-45AF Ethernet modules, listed in Table 2-18, provide 96 10/100-Mbps full- or half-duplex ports. The WS-X6148X2-RJ-45 and the WS-X6148X2-RJ-45AF modules, see Figure 2-8, are shipped with a 96-port splitter panel (WS-F6K-48X2-SPLTR). (See Figure 2-9.)

Table 2-18 WS-X6148X2-RJ-45 and the WS-X6148X2-45AF Ethernet modules

Module	Description
WS-X6148X2-RJ-45	Base module without daughter cards installed.
WS-X6148X2-45AF	Base module equipped with a factory-installed IEEE 802.3af PoE daughter card (WS-F6K-GE48-AF).

Figure 2-8 WS-X6148X2-RJ-45 Ethernet Module Front Panel

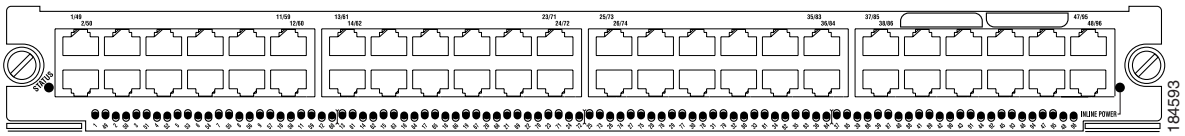


Figure 2-9 WS-F6K-48X2-SPLTR Splitter Panel

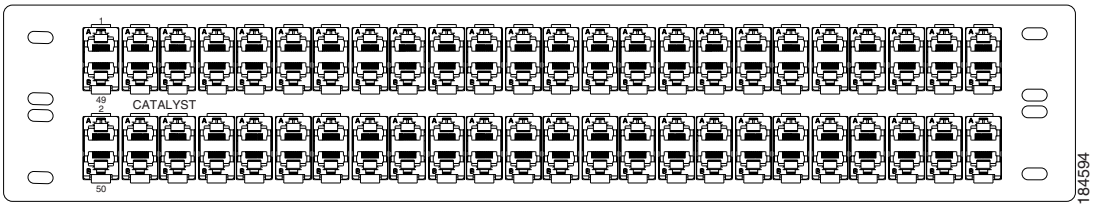


Table 2-19 lists the features for the modules, and Table 2-20 lists the physical and environmental specifications for the module.

Note With the IEEE 802.3af PoE daughter card installed, the WS-X6148X2-RJ-45 module can support up to 48 Class 3 (15.4 W) devices per module when operating as a 48-port module or up to 96 Class 2 (7 W) devices per module when operating as a 96-port module.

Table 2-19 WS-X6148X2-RJ-45 and WS-X6148X2-45AF Ethernet Modules Features

Feature	Description
Ports per module	48, but scalable to 96 ports with the use of the supplied splitter panel (both modules)
Connector type	RJ-45 (both modules) RJ-45 (splitter panel)
Cabling distance	328 ft (100 m) over Category 5, 5e, and 6 UTP/STP cable (both modules)
Speed	10/100 IEEE 802.3 double-speed autonegotiation (both modules)
Buffer size	1.116 MB per port (both modules)
Maximum frame size	Up to 9216 bytes per frame (both modules)
Supervisor engine support	Supported on the following supervisor engines: • Supervisor Engine 2 • Supervisor Engine 32 • Supervisor Engine 720
Queues per port	Both modules: • Tx—2q2t • Rx—1q4t
Chassis/slot restrictions	No chassis or slot restrictions; the module can occupy any slot in any Catalyst 6500 or Catalyst 6500-E chassis.
Bus connection	Single connection into the 32-Gbps shared bus (both modules)
Module upgrades available	
PoE support	• WS-X6148X2-RJ-45—Field upgradeable to both Cisco prestandard and IEEE 802.3af with the WS-F6K-FE48X2-AF= PoE daughter card. **Note** With the IEEE 802.3af PoE daughter card installed, the WS-X6148X2-RJ-45 module can support up to 48 Class 3 (15.4 W) devices per module when operating as a 48-port module or up to 96 Class 2 (7 W) devices per module when operating as a 96-port module. See the *Cisco Catalyst 6500 Series Power over Ethernet Daughter Cards Field-Upgrade Installation Note* for field upgrade procedures. See Appendix A for further information on the PoE daughter cards.
Distributed forwarding support	Not supported.
Pluggable transceivers support	Not supported.

Table 2-19 WS-X6148X2-RJ-45 and WS-X6148X2-45AF Ethernet Modules Features (continued)

Feature	Description
TDR support	Not supported
Module front panel LEDs	**STATUS** • Green—All diagnostics pass; the module is operational. • Orange—The module is booting or running diagnostics. An overtemperature condition has occurred. (A minor temperature threshold has been exceeded during environmental monitoring.) • Red—The module is resetting. The switch has just been powered on or the module has been hot inserted during the normal initialization sequence. An overtemperature condition has occurred. (A major temperature threshold has been exceeded during environmental monitoring.) If the module fails to download code and configuration information successfully during the initial reset, the LED stays red; the module does not come online. **LINK** • Green—The port is active (the link is connected and operational). • Orange—The module or port is disabled through the CLI command or the module is initializing. • Flashing orange—The port is faulty and has been disabled. • Off—The port is not active or the link is not connected. **PHONE** • Green—The PoE daughter card is installed and detected. • Off—The PoE daughter card is not detected or is not installed.

Table 2-20 WS-X6148X2-RJ-45 Specifications

Item	Specification
Dimensions (H x W x D)	Module—1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm). Occupies one slot in the chassis. Splitter panel—3.5 x 19 x 1.25 in. (8.9 x 48.26 x 3.18 cm). Occupies 2 RUs in the rack.
Weight	WS-X6148X2-RJ-45 (base module)—7.2 lb (3.26 kg) Splitter panel—5.2 lb (2.36 kg)
Power requirement (at 42 VDC)	• WS-X6148X2-RJ-45 (base module)—2.65 A • WS-X6148X2-45AF (base module + PoE daughter card)—3.07 A
Environment	
Operating temperature	• Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (noncondensing)	10 to 90%
Operating altitude	• Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)

WS-X6196-RJ-21 and WS-X6196-21AF Ethernet Modules

The WS-X6196-RJ-21 and the WS-X6196-21AF Ethernet modules, listed in Table 2-21, provide 96 10/100-Mbps full- or half-duplex ports. Figure 2-10 shows the module front panel.

Table 2-21 WS-X6196-RJ-21 Modules

Module	Description
WS-X6196-RJ-21	Base module without daughter cards installed.
WS-X6196-21AF	Base module equipped with a factory-installed IEEE 802.3af PoE daughter card (WS-F6K-GE48-AF).

Figure 2-10 WS-X6196-RJ-21 Switching Module Front Panel

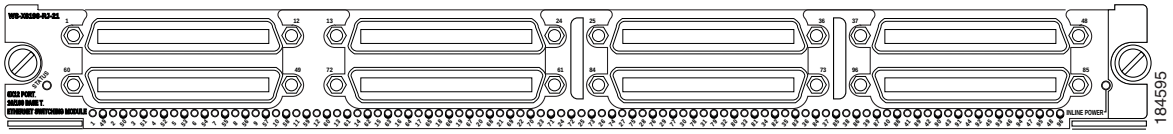


Table 2-22 lists the module features, and Table 2-23 lists the module physical and environmental specifications.

Note With the PoE daughter card installed, the WS-X6196-RJ-21 module can support 96 Class 2 (7 W) devices or 62 Class 3 (15.4 W) devices per module.

Table 2-22 WS-X6196-RJ-21 and WS-X6196-21AF Ethernet Modules Features

Feature	Description
Ports per module	96 ports (both modules)
Connector type	RJ-21 (both modules)
Cabling distance	328 ft (100 m) over Category 5, 5e, and 6 UTP/STP cable (both modules)
Speed	10/100 IEEE 802.3 double-speed autonegotiation (both modules)
Buffer size	1.116 MB per port (both modules)
Maximum frame size	Up to 9216 bytes (both modules)
Supervisor engine support	Supported on the following supervisor engines: • Supervisor Engine 2 • Supervisor Engine 32 • Supervisor Engine 720
Queues per port	Both modules: • Tx—1p3q1t • Rx—1p1q0t

Table 2-22 WS-X6196-RJ-21 and WS-X6196-21AF Ethernet Modules Features (continued)

Feature	Description
Chassis/slot restrictions	No chassis or slot restrictions; the module can occupy any slot in any Catalyst 6500 or Catalyst 6500-E chassis.
Bus connection	32-Gbps shared bus (both modules)
Module upgrades available	
PoE support	WS-X6196-RJ-21—Field upgradeable to both Cisco prestandard and IEEE 802.3af with the WS-F6K-FE48X2-AF= PoE daughter card. **Note** With the PoE daughter card installed, the WS-X6196-RJ-21 module can support 96 Class 2 (7 W) devices or 62 Class 3 (15.4 W) devices per module. See the *Cisco Catalyst 6500 Series Power over Ethernet Daughter Cards Field-Upgrade Installation Note* for field upgrade procedures. See Appendix A for further information on the PoE daughter cards.
Distributed forwarding support	Not supported.
Pluggable transceivers support	Not supported.
TDR support	Not supported.
Module front panel LEDs	**STATUS** • Green—All diagnostics pass; the module is operational. • Orange—The module is booting or running diagnostics. An overtemperature condition has occurred. (A minor temperature threshold has been exceeded during environmental monitoring.) • Red—The module is resetting. The switch has just been powered on or the module has been hot inserted during the normal initialization sequence. An overtemperature condition has occurred. (A major temperature threshold has been exceeded during environmental monitoring.) If the module fails to download code and configuration information successfully during the initial reset, the LED stays red; the module does not come online. **LINK** • Green—The port is active (the link is connected and operational). • Orange—The module or port is disabled through the CLI command or the module is initializing. • Flashing orange—The port is faulty and has been disabled. • Off—The port is not active or the link is not connected. **PHONE** • Green—The PoE daughter card is installed and detected. • Off—The PoE daughter card is not detected or is not installed.

Table 2-23 WS-X6196-RJ-21 and WS-X6196-21AF Ethernet Modules Specifications

Item	Specification
Dimensions (H x W x D)	1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm). Occupies one slot in the chassis.
Weight	WS-X6196-RJ-21—7.8 lb (3.54 kg) WS-X6196-21AF—11.2 lb (5.08 kg)
Power requirement (at 42 VDC)	• WS-X6196-RJ-21 (base module)—2.74 A • WS-X6196-21AF (base module + PoE daughter card)—3.16 A
Environment	
Operating temperature	• Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (noncondensing)	10 to 90%
Operating altitude	• Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)

WS-X6348-RJ21V Ethernet Module

The WS-X6348-RJ21V Ethernet module (Figure 2-11) provides 48 10/100-Mbps full- or half-duplex ports. Table 2-24 lists the features and description for the module, and Table 2-25 lists the physical and environmental specifications for the module.

Figure 2-11 WS-X6348-RJ21 Switching Module

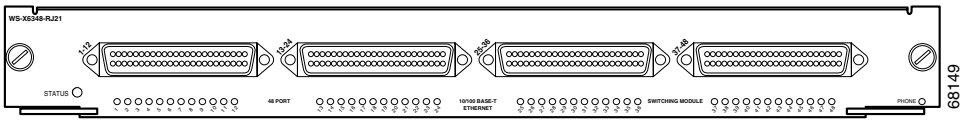


Table 2-24 WS-X6348-RJ21V Features

Feature	Description
Ports per module	48
Connector type	RJ-21
Cabling distance	328 ft (100 m) over Category 5, 5e, and 6 UTP/STP cable
Speed	10/100 IEEE 802.3 double-speed autonegotiation
Buffer size	128 KB
Maximum frame size	Up to 8092 bytes per frame
Supervisor engine support	Supported on the following supervisor engines: • Supervisor Engine 2 • Supervisor Engine 32 • Supervisor Engine 720
Queues per port	• Tx—2q2t • Rx—1q4t
Chassis/slot restrictions	No chassis or slot restrictions; the module can occupy any slot in any Catalyst 6500 or Catalyst 6500-E chassis.
Bus connection	32-Gbps shared bus

Table 2-24 WS-X6348-RJ21V Features (continued)

Feature	Description
Module upgrades available	
PoE support	Cisco prestandard only. The WS-F6K-VPWR= PoE daughter card is factory installed on the module. No PoE field upgrades are available.
Distributed forwarding support	Not supported.
Pluggable transceivers support	Not supported.
TDR support	Not supported.
Module front panel LEDs	**STATUS** • Green—All diagnostics pass; the module is operational. • Orange—The module is booting or running diagnostics. An overtemperature condition has occurred. (A minor temperature threshold has been exceeded during environmental monitoring.) • Red—The module is resetting. The switch has just been powered on or the module has been hot inserted during the normal initialization sequence. An overtemperature condition has occurred. (A major temperature threshold has been exceeded during environmental monitoring.) If the module fails to download code and configuration information successfully during the initial reset, the LED stays red; the module does not come online. **LINK** • Green—The port is active (the link is connected and operational). • Orange—The module or port is disabled through the CLI command or the module is initializing. • Flashing orange—The port is faulty and has been disabled. • Off—The port is not active or the link is not connected. **PHONE** • Green—The PoE daughter card is installed and detected. • Off—The PoE daughter card is not detected or is not installed.

Table 2-25 WS-X6348-RJ21V Specifications

Item	Specification
Dimensions (H x W x D)	1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm). Occupies one slot in the chassis.
Weight	9.1 lb (4.13 kg)
Power required (at 42 VDC)	2.81 A
Environment	
Operating temperature	• Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (noncondensing)	10 to 90%
Operating altitude	• Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)

WS-X6348-RJ45 and WS-X6348-RJ45V Ethernet Modules

The WS-X6348-RJ45 and the WS-X6348-RJ45V Ethernet modules, listed in Table 2-26, provide 48 10/100-Mbps full- or half-duplex ports. Figure 2-12 shows the module front panel.

Table 2-26 WS-X6348-RJ45 Modules

Module	Description
WS-X6348-RJ45	Base module without daughter cards installed.
WS-X6348-RJ45V	Base module equipped with a factory-installed Cisco prestandard PoE daughter card (WS-F6K-VPWR-GE).

Figure 2-12 WS-X6348-RJ45 and WS-X6348-RJ45V Ethernet Modules Front Panel

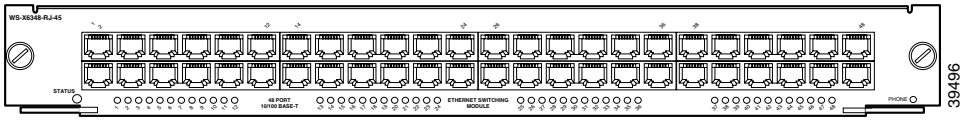


Table 2-27 lists the module features, and Table 2-28 lists the module physical and environmental specifications.

Table 2-27 WS-X6348-RJ45 and WS-X6348-RJ45V Ethernet Modules Features

Feature	Description
Ports per module	48 (both modules)
Connector type	RJ-45 (both modules)
Cabling distance	328 ft (100 m) over Category 5, 5e, and 6 UTP/STP cable (both modules)
Speed	10/100 IEEE 802.3 double-speed autonegotiation (both modules)
Buffer size	128 KB per port (both modules)
Maximum frame size	Up to 8092 bytes per frame (both modules)
Supervisor engine support	Supported on the following supervisor engines: • Supervisor Engine 2 • Supervisor Engine 32 • Supervisor Engine 720
Queues per port	Both modules: • Tx—2q2t • Rx—1q4t
Chassis/slot restrictions	No chassis or slot restrictions; the modules can occupy any slot in any Catalyst 6500 or Catalyst 6500-E chassis.
Bus connection	32-Gbps shared bus (both modules)

Table 2-27 WS-X6348-RJ45 and WS-X6348-RJ45V Ethernet Modules Features (continued)

Feature	Description
Module upgrades available	
PoE support	• WS-X6348-RJ45—Field upgradeable to Cisco prestandard with the WS-F6K-VPWR= PoE daughter card. See the *Cisco Catalyst 6500 Series Power over Ethernet Daughter Cards Field-Upgrade Installation Note* for field upgrade procedures. See Appendix A for further information on the PoE daughter cards.
Distributed forwarding support	Not supported.
Pluggable transceivers support	Not supported.
TDR support	Not supported.
Module front panel LEDs	**STATUS** • Green—All diagnostics pass; the module is operational. • Orange—The module is booting or running diagnostics. An overtemperature condition has occurred. (A minor temperature threshold has been exceeded during environmental monitoring.) • Red—The module is resetting. The switch has just been powered on or the module has been hot inserted during the normal initialization sequence. An overtemperature condition has occurred. (A major temperature threshold has been exceeded during environmental monitoring.) If the module fails to download code and configuration information successfully during the initial reset, the LED stays red; the module does not come online. **LINK** • Green—The port is active (the link is connected and operational). • Orange—The module or port is disabled through the CLI command or the module is initializing. • Flashing orange—The port is faulty and has been disabled. • Off—The port is not active or the link is not connected. **PHONE** • Green—The PoE daughter card is installed and detected. • Off—The PoE daughter card is not detected or is not installed.

Table 2-28 WS-X6348-RJ45 and WS-X6348-RJ45V Specifications

Item	Specification
Dimensions (H x W x D)	1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm). Occupies one slot in the chassis.
Weight	• WS-X6348-RJ45—7.2 lb (3.26 kg) • WS-X6348-RJ45V—8.8 lb (3.99 kg)
Power requirement (at 42 VDC)	• WS-X6348-RJ45—2.39 A • WS-X6348-RJ45V (base module + PoE daughter card)—2.81 A
Environment	
Operating temperature	• Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (noncondensing)	10 to 90%
Operating altitude	• Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)

WS-X6516-GE-TX Ethernet Module

The WS-X6516-GE-TX Ethernet module (Figure 2-13) provides 16 10/100/1000-Mbps full- or half-duplex ports. Table 2-29 lists the features and description for the module, and Table 2-30 lists the physical and environmental specifications for the module.

Figure 2-13 WS-X6516-GE-TX Ethernet Module

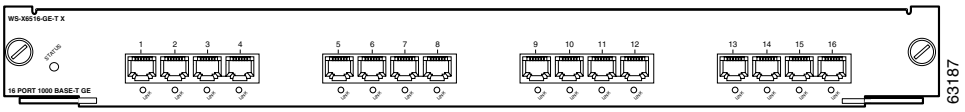


Table 2-29 WS-X6516-GE-TX Ethernet Module Features

Feature	Description
Ports per module	16
Connector type	RJ-45
Cabling distance	328 ft (100 m) over Category 5, 5e, and 6 UTP/STP cable
Speed	10/100/1000 IEEE 802.3 triple-speed autonegotiation
Buffer size	512 KB per port
Maximum frame size	Up to 9216 bytes per frame
Supervisor engine support	Supported on the following supervisor engines: • Supervisor Engine 2 • Supervisor Engine 32 • Supervisor Engine 720
Queues per port	• Tx—1p2q2t • Rx—1p1q4t
Chassis/slot restrictions	No chassis or slot restrictions; the module can occupy any slot in any Catalyst 6500 or Catalyst 6500-E chassis.
Bus connection	32-Gbps shared bus
Module upgrades available	
PoE support	Not supported.
Distributed forwarding support	Not supported.
Pluggable transceivers support	Not supported.
TDR support	Not supported.

Table 2-29 WS-X6516-GE-TX Ethernet Module Features (continued)

Feature	Description
Module front panel LEDs	**STATUS** • Green—All diagnostics pass; the module is operational. • Orange—The module is booting or running diagnostics. An overtemperature condition has occurred. (A minor temperature threshold has been exceeded during environmental monitoring.) • Red—The module is resetting. The switch has just been powered on or the module has been hot inserted during the normal initialization sequence. An overtemperature condition has occurred. (A major temperature threshold has been exceeded during environmental monitoring.) If the module fails to download code and configuration information successfully during the initial reset, the LED stays red; the module does not come online. **LINK** • Green—The port is active (the link is connected and operational). • Orange—The module or port is disabled through the CLI command or the module is initializing[1]. • Flashing orange—The port is faulty and has been disabled. • Off—The port is not active or the link is not connected. **PHONE** • Green—The PoE daughter card is installed and detected. • Off—The PoE daughter card is not detected or is not installed.

1. Verify that all LINK LEDs are functioning.

Table 2-30 WS-X6516-GE-TX Ethernet Module Specifications

Item	Specification
Dimensions (H x W x D)	1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm). Occupies one slot in the chassis.
Weight	7.65 lb (3.43 kg)
Power requirement (at 42 VDC)	3.45 A
Environment	
Operating temperature	• Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (noncondensing)	10 to 90%
Operating altitude	• Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)

WS-X6548-GE-TX, WS-X6548-GE-45AF, and WS-X6548V-GE-TX Ethernet Modules

The WS-X6548-GE-TX Ethernet module and its variants, listed in Table 2-31, provide 48 10/100/1000-Mbps full- or half-duplex ports. Figure 2-14 shows the module front panel.

Table 2-31 WS-X6548-GE-TX Ethernet Module Variants

Module	Description
WS-X6548-GE-TX	Base module without daughter cards installed.
WS-X6548-GE-45AF	Base module equipped with a factory-installed IEEE 802.3af PoE daughter card (WS-F6K-GE48-AF).
WS-X6548V-GE-TX	Base module equipped with a factory-installed Cisco prestandard PoE daughter card (WS-F6K-VPWR-GE).

Figure 2-14 WS-X6548-GE-TX Ethernet Module Front Panel

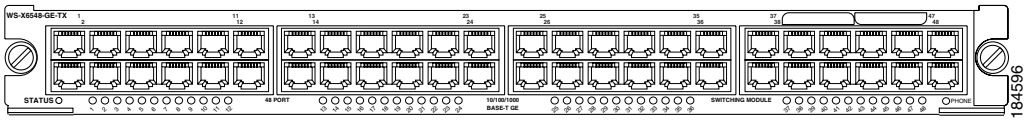


Table 2-32 lists the features and descriptions for the modules, and Table 2-33 lists the physical and environmental specifications for the modules.

Table 2-32 WS-X6548-GE-TX Modules Features

Feature	Description
Ports per module	48 (all variants)
Connector type	RJ-45 (all variants)
Cabling distance	328 ft (100 m) over Category 5, 5e, and 6 UTP/STP cable (all variants)
Speed	10/100/1000 IEEE 802.3 triple-speed autonegotiation (all variants)
Buffer size	1.4 MB per 8 ports
Maximum frame size	Up to 1518 bytes per frame
Supervisor engine support	Supported on the following supervisor engines: • Supervisor Engine 2 • Supervisor Engine 32 • Supervisor Engine 720
Queues per port	• Tx—1p2q2t (per 8 ports) • Rx—1p2t (per 8 ports)
Chassis/slot restrictions	No chassis or slot restrictions; the module can occupy any slot in any Catalyst 6500 or Catalyst 6500-E chassis (all variants).
Bus connection	32-Gbps shared bus (all variants)

Table 2-32 WS-X6548-GE-TX Modules Features (continued)

Feature	Description
Module upgrades available	
PoE support	WS-X6548-GE-TX—Field-upgradeable to Cisco prestandard only by installing the WS-F6K-VPWR-GE= daughter card or both Cisco prestandard and IEEE 802.3af by installing the WS-F6K-GE48-AF= daughter card. **Note** Refer to the *Cisco Catalyst 6500 Series Power over Ethernet Daughter Cards Field-Upgrade Installation Note* for field upgrade procedures.
Distributed forwarding support	Not supported.
Pluggable transceivers support	Not supported.
TDR support	All module variants support TDR.
Module front panel LEDs	**STATUS** • Green—All diagnostics pass; the module is operational. • Orange—The module is booting or running diagnostics. An overtemperature condition has occurred. (A minor temperature threshold has been exceeded during environmental monitoring.) • Red—The module is resetting. The switch has just been powered on or the module has been hot inserted during the normal initialization sequence. An overtemperature condition has occurred. (A major temperature threshold has been exceeded during environmental monitoring.) If the module fails to download code and configuration information successfully during the initial reset, the LED stays red; the module does not come online. **LINK** • Green—The port is active (the link is connected and operational). • Orange—The module or port is disabled through the CLI command or the module is initializing[1]. • Flashing orange—The port is faulty and has been disabled. • Off—The port is not active or the link is not connected. **PHONE** • Green—The PoE daughter card is installed and detected. • Off—The PoE daughter card is not detected or is not installed.

1. Verify that all LINK LEDs are functioning.

Table 2-33 WS-X6548-GE-TX and Variants Specifications

Item	Specification
Dimensions (H x W x D)	1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm). Occupies one slot in the chassis.
Weight	Base module—7.2 lb (3.3 kg)
Power requirement (at 42 VDC)	• WS-X6548-GE-TX (base module)—2.98 A • WS-X6548-GE-45AF (base module + PoE daughter card)—3.16 A • WS-X6548V-GE-TX (base module + PoE daughter card)—3.40 A
Environment	
Operating temperature	• Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (noncondensing)	10 to 90%
Operating altitude	• Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)

WS-X6548-RJ-21 Ethernet Module

The WS-X6548-RJ-21 Ethernet module (Figure 2-15) provides 48 10/100-Mbps full- or half-duplex ports. Table 2-34 lists the features and description of the module, and Table 2-35 lists the physical and environmental specifications for the module.

Figure 2-15 WS-X6548-RJ-21 Ethernet Module Front Panel

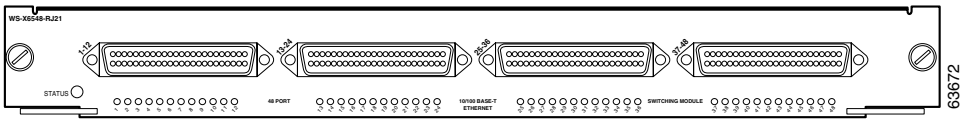


Table 2-34 WS-X6548-RJ-21 Ethernet Module Features

Feature	Description
Ports per module	48 ports
Connector type	RJ-21
Cabling distance	328 ft (100 m) over Category 5, 5e, and 6 UTP/STP cable
Speed	10/100 IEEE 802.3 double-speed autonegotiation
Buffer size	1.116 MB per port
Maximum frame size	Up to 1518 bytes per frame.
Supervisor engine support	All module variants support all supervisor engines.
Queues per port	• Tx—1p3q8t • Rx—1q2t
Chassis/slot restrictions	No chassis or slot restrictions; the module can occupy any slot in any Catalyst 6500 or Catalyst 6500-E chassis.
Bus connection	32-Gbps shared bus
Module upgrades available	
PoE support	Not available.
Distributed forwarding support	Can be field-upgraded with either the WS-F6K-DFC, WS-F6K-DFC3B, or WS-F6K-DFC3BXL daughter cards. See the *Catalyst 6500 Series DFC, DFC3A, DFC3B, and DFC3BXL Installation Note* for additional information and field upgrade procedures. See Appendix A for additional information on the DFC daughter cards.
Pluggable transceivers support	Not supported.

Table 2-34 WS-X6548-RJ-21 Ethernet Module Features (continued)

Feature	Description
TDR support	Not supported.
Module front panel LEDs	**STATUS** • Green—All diagnostics pass; the module is operational. • Orange—The module is booting or running diagnostics. An overtemperature condition has occurred. (A minor temperature threshold has been exceeded during environmental monitoring.) • Red—The module is resetting. The switch has just been powered on or the module has been hot inserted during the normal initialization sequence. An overtemperature condition has occurred. (A major temperature threshold has been exceeded during environmental monitoring.) If the module fails to download code and configuration information successfully during the initial reset, the LED stays red; the module does not come online. **LINK** • Green—The port is active (the link is connected and operational). • Orange—The module or port is disabled through the CLI command or the module is initializing[1]. • Flashing orange—The port is faulty and has been disabled. • Off—The port is not active or the link is not connected. **PHONE** • Green—The PoE daughter card is installed and detected. • Off—The PoE daughter card is not detected or is not installed.

1. Verify that all LINK LEDs are functioning.

Table 2-35 WS-X6548-RJ-21 Specifications

Item	Specification
Dimensions (H x W x D)	1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm). Occupies one slot in the chassis.
Weight	7.6 lb (3.45 kg)
Power required (at 42 VDC)	2.90 A
Environment	
Operating temperature	• Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (noncondensing)	10 to 90%
Operating altitude	• Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)

WS-X6548-RJ-45 Ethernet Module

The WS-X6548-RJ-45 Ethernet module (Figure 2-16) provides 48 10/100-Mbps full- or half-duplex ports. Table 2-36 lists the features and descriptions of the module, and Table 2-37 lists the physical and environmental specifications for the module.

Figure 2-16 WS-X6548-RJ-45 Switching Module Front Panel

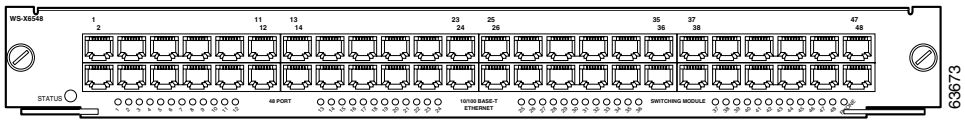


Table 2-36 WS-X6548-RJ-45 Features

Feature	Description
Ports per module	48 ports
Connector type	RJ-45
Cabling distance	328 ft (100 m) over Category 5, 5e, and 6 UTP/STP cable
Speed	10/100 IEEE 802.3 double-speed autonegotiation
Buffer size	1.116 MB per port
Maximum frame size	Up to 1518 bytes per frame
Supervisor engine support	Supported on the following supervisor engines: • Supervisor Engine 2 • Supervisor Engine 32 • Supervisor Engine 720
Queues per port	• Tx—1p3q1t • Rx—1p1q
Chassis/slot restrictions	No chassis or slot restrictions; the module can occupy any slot in any Catalyst 6500 or Catalyst 6500-E chassis.
Bus connection	One 8-Gbps fabric connection and 32-Gbps shared bus
Module upgrades available	
PoE support	Not supported.
Distributed forwarding support	Can be field-upgraded with either the WS-F6K-DFC, WS-F6K-DFC3B, or WS-F6K-DFC3BXL daughter cards. See the *Catalyst 6500 Series DFC, DFC3A, DFC3B, and DFC3BXL Installation Note* for additional information and field upgrade procedures. See Appendix A for additional information on the DFC daughter cards.
Pluggable transceivers support	Not supported.

Table 2-36 WS-X6548-RJ-45 Features (continued)

Feature	Description
TDR support	Not supported.
Module front panel LEDs	**STATUS** • Green—All diagnostics pass; the module is operational. • Orange—The module is booting or running diagnostics. An overtemperature condition has occurred. (A minor temperature threshold has been exceeded during environmental monitoring.) • Red—The module is resetting. The switch has just been powered on or the module has been hot inserted during the normal initialization sequence. An overtemperature condition has occurred. (A major temperature threshold has been exceeded during environmental monitoring.) If the module fails to download code and configuration information successfully during the initial reset, the LED stays red; the module does not come online. **LINK** • Green—The port is active (the link is connected and operational). • Orange—The module or port is disabled through the CLI command or the module is initializing[1]. • Flashing orange—The port is faulty and has been disabled. • Off—The port is not active or the link is not connected. **PHONE** • Green—The PoE daughter card is installed and detected. • Off—The PoE daughter card is not detected or is not installed.

1. Verify that all LINK LEDs are functioning.

Table 2-37 WS-X6548-RJ-45 Specifications

Item	Specification
Dimensions (H x W x D)	1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm). Occupies one slot in the chassis.
Weight	7.6 lb (3.45 kg)
Power required (at 42 VDC)	2.9 A
Environment	
Operating temperature	• Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (noncondensing)	10 to 90%
Operating altitude	• Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)

WS-X6748-GE-TX Ethernet Module

The WS-X6748-GE-TX Ethernet module (Figure 2-17) provides 48 10/100/1000-Mbps full- or half-duplex ports. Table 2-38 lists the module features, and Table 2-39 lists the module physical and environmental specifications.

Figure 2-17 WS-X6748-GE-TX Ethernet Module Front Panel

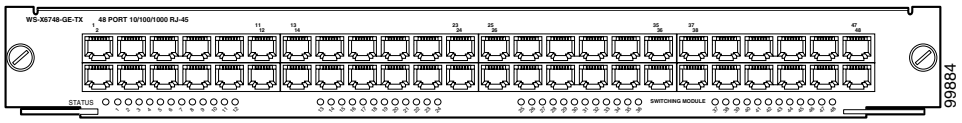


Table 2-38 WS-X6748-GE-TX Ethernet Module Features

Feature	Description
Ports per module	48 ports
Connector type	RJ-45
Cabling distance	328 ft (100 m) over Category 5, 5e, and 6 UTP/STP cable
Speed	10/100/1000 IEEE 802.3 triple-speed autonegotiation
Buffer size	1.3 MB per port
Maximum frame size	Up to 9216 bytes per frame
Supervisor engine support	Supported on the following supervisor engines: • Supervisor Engine 720
Queues per port	• Tx—1p3q8t • Rx—1q8t (when using distributed CEF)
Chassis/slot restrictions	The module can occupy any slot in any Catalyst 6500 or Catalyst 6500-E chassis except the Catalyst 6513 chassis where the module must be installed in slots 9 through 13.
Bus connection	Dual 20-GBps channel connection to the switch fabric on the Supervisor Engine 720
Module upgrades available	
PoE support	Not supported.
Distributed forwarding support	• Can be upgraded in the field to support dCEF with the installation of a dCEF daughter card (WS-F6700-DFC3A, WS-F6700-DFC3B, or the WS-F6700-DFC3BXL). See the *Catalyst 6500 Series DFC, DFC3A, DFC3B, and DFC3BXL Installation Note* for additional information and field upgrade procedures. See Appendix A for additional information on the DFC daughter cards.
Pluggable transceivers support	Not supported.

Table 2-38 WS-X6748-GE-TX Ethernet Module Features (continued)

Feature	Description
TDR support	Supported.
Module front panel LEDs	**STATUS** • Green—All diagnostics pass; the module is operational. • Orange—The module is booting or running diagnostics. An overtemperature condition has occurred. (A minor temperature threshold has been exceeded during environmental monitoring.) • Red—The module is resetting. The switch has just been powered on or the module has been hot inserted during the normal initialization sequence. An overtemperature condition has occurred. (A major temperature threshold has been exceeded during environmental monitoring.) If the module fails to download code and configuration information successfully during the initial reset, the LED stays red; the module does not come online. **LINK** Green—The port is active (the link is connected and operational). Orange—The module or port is disabled through the CLI command or the module is initializing[1]. Flashing orange—The port is faulty and has been disabled. Off—The port is not active or the link is not connected. **PHONE** Green—The PoE daughter card is installed and detected. Off—The PoE daughter card is not detected or is not installed.

1. Verify that all LINK LEDs are functioning.

Table 2-39 WS-X6748-GE-TX Specifications

Item	Specification
Dimensions (H x W x D)	1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm). Occupies one slot in the chassis.
Weight	Base module + CFC daughter card (WS-F6700-CFC)—10.2 lb (4.63 kg)
Power requirement (at 42 VDC)	7.0 A
Environment	
Operating temperature	• Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (noncondensing)	10 to 90%
Operating altitude	• Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)

1-Gigabit Ethernet Modules

This section describes the following 1-Gigabit Ethernet modules:

- WS-X6408A-GBIC, page 2-50
- WS-X6416-GBIC, page 2-53
- WS-X6516-GBIC and WS-X6516A-GBIC, page 2-55
- WS-X6724-SFP, page 2-58
- WS-X6748-SFP, page 2-61
- WS-X6816-GBIC, page 2-64

WS-X6408A-GBIC

The WS-X6408A-GBIC Ethernet module (Figure 2-18) provides 8 1-Gbps full- or half-duplex ports. Table 2-40 lists the features and descriptions for the module, and Table 2-41 lists the physical and environmental specifications for the module.

Figure 2-18 WS-X6408A-GBIC Ethernet Module Front Panel

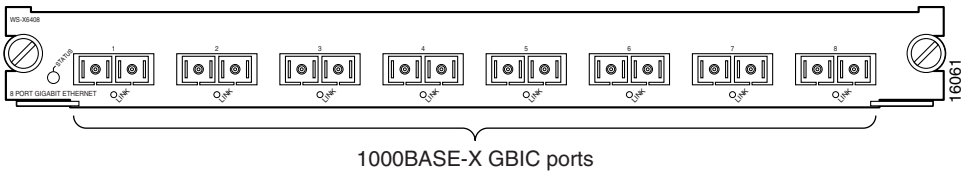


Table 2-40 WS-X6408A-GBIC Ethernet Module Features

Feature	Description
Ports per module	8
Connector type	SC or RJ-45 depending on the GBIC transceiver installed
Cabling distance	Depends on the GBIC transceiver installed in the module port. Refer to Appendix B for descriptions of the GBIC transceiver types and supported cabling distances.
Speed	1 Gbps
Buffer size	512 KB per port
Maximum frame size	Up to 9216 bytes per frame
Supervisor engine support	Supported on the following supervisor engines: • Supervisor Engine 2 • Supervisor Engine 32 • Supervisor Engine 720
Queues per port	• Tx—1p2q2t • Rx—1p1q4t
Chassis/slot restrictions	No chassis or slot restrictions; the module can occupy any slot in any Catalyst 6500 or Catalyst 6500-E chassis.
Bus connection	32 Gbps shared bus
Module upgrades available	
PoE support	Not supported.
Distributed forwarding support	Not supported.
Pluggable transceivers support	GBIC transceivers are supported. Refer to your software release notes to determine which GBIC transceivers are supported. Refer to Appendix B for additional information on the GBIC transceivers.

Table 2-40 WS-X6408A-GBIC Ethernet Module Features (continued)

Feature	Description
TDR support	Not supported.
Module front panel LEDs	**STATUS** • Green—All diagnostics pass; the module is operational. • Orange—The module is booting or running diagnostics; an overtemperature condition has occurred. **LINK** • Green—The port is active (the link is connected and operational). • Flashing orange—The port failed diagnostics and is disabled. • Orange—The port is disabled. • Red—The module is resetting; an overtemperature condition has occurred. **Note** If the module fails to download code and configuration information successfully during the initial reset, the LED stays red; the module does not come online. • Off—The port is not active or the link is not connected.

Table 2-41 WS-X6408A-GBIC Physical and Environmental Specifications

Item	Specification
Dimensions (H x W x D)	1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm). Occupies one slot in the chassis.
Weight	6.4 lb (2.9 kg)
Power requirement (at 42 VDC)	2.00 A
Environment	
Operating temperature	• Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (noncondensing)	10 to 90%
Operating altitude	• Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)

WS-X6416-GBIC

The WS-X6416-GBIC Ethernet module (Figure 2-19) provides 16 1-Gbps full- or half-duplex ports. Table 2-42 lists the module features, and Table 2-43 lists the module physical and environmental specifications.

Figure 2-19 WS-X6416-GBIC Ethernet Module Front Panel

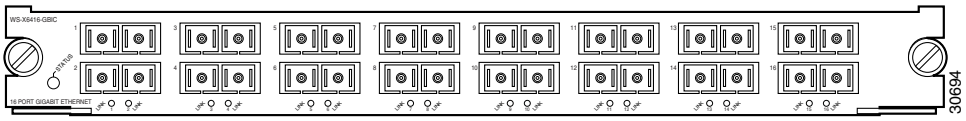


Table 2-42 WS-X6416-GBIC Features

Feature	Description
Ports per module	16
Connector type	SC or RJ-45 depending on the GBIC transceiver installed
Cabling distance	Depends on the GBIC transceiver installed in the module port. Refer to Appendix B for descriptions of the GBIC transceiver types and supported cabling distances.
Speed	1 Gbps
Buffer size	512 KB per port
Maximum frame size	Up to 9216 bytes per frame
Supervisor engine support	Supported on the following supervisor engines: • Supervisor Engine 2 • Supervisor Engine 32 • Supervisor Engine 720
Queues per port	• Tx—1p2q2t • Rx—1p1q4t
Chassis/slot restrictions	No chassis or slot restrictions; the module can occupy any slot in any Catalyst 6500 or Catalyst 6500-E chassis.
Bus connection	32-Gbps shared bus
Forwarding architecture	Cisco Express Forwarding (CEF)
Module upgrades available	
PoE support	Not supported.
Distributed forwarding support	Not supported.
Pluggable transceivers support	GBIC transceivers are supported. Refer to your software release notes to determine which GBIC transceivers are supported. Refer to Appendix B for additional information on the GBIC transceivers.

Table 2-42 WS-X6416-GBIC Features (continued)

Feature	Description
Digital Optical Monitoring (DOM) support	Supported on some GBIC transceivers **Note** Refer to your software release notes for specific information on which GBIC transceivers support DOM and the software release required for support.
Module front panel LEDs	**STATUS** • Green—All diagnostics pass; the module is operational. • Orange—The module is booting or running diagnostics; an overtemperature condition has occurred. **LINK** • Green—The port is active (the link is connected and operational). • Flashing orange—The port failed diagnostics and is disabled. • Orange—The port is disabled. • Red—The module is resetting; an overtemperature condition has occurred. **Note** If the module fails to download code and configuration information successfully during the initial reset, the LED stays red; the module does not come online. • Off—The port is not active or the link is not connected.

Table 2-43 WS-X6416-GBIC Ethernet Module Physical and Environmental Specifications

Item	Specification
Dimensions (H x W x D)	1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm). Occupies one slot in the chassis.
Weight	7.0 lb (3.17 kg)
Power requirement (at 42 VDC)	2.81 A
Environment	
Operating temperature	• Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (noncondensing)	10 to 90%
Operating altitude	• Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)

WS-X6516-GBIC and WS-X6516A-GBIC

The WS-X6516-GBIC and the WS-X6516A-GBIC Ethernet modules (Figure 2-20) provide 16 1-Gbps full- or half-duplex ports. Table 2-44 lists the module features, and Table 2-45 lists the module physical and environmental specifications.

Figure 2-20 WS-X6516-GBIC and WS-X6516A-GBIC Ethernet Modules Front Panel

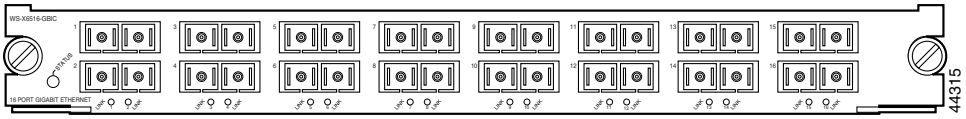


Table 2-44 WS-X6516-GBIC and WS-X6516A-GBIC Features

Feature	Description
Ports per module	16
Connector type	SC or RJ-45 depending on the type of GBIC transceiver installed in the module port
Cabling distance	Depends on the GBIC transceiver installed in the module port. Refer to Appendix B for descriptions of the GBIC transceiver types and supported cabling distances.
Speed	1 Gbps
Buffer size	• 512 KB per port—WS-X6516-GBIC • 1 MB per port—WS-X6516A-GBIC
Maximum frame size	Up to 9216 bytes per frame (both modules)
Supervisor engine support	Supported on the following supervisor engines: • Supervisor Engine 2 • Supervisor Engine 32 • Supervisor Engine 720
Queues per port	Both modules: • Tx—1p2q2t • Rx—1p1q4t
Chassis/slot restrictions	No chassis or slot restrictions; the module can occupy any slot in any Catalyst 6500 or Catalyst 6500-E chassis.
Bus connection	32-Gbps shared bus

Table 2-44 WS-X6516-GBIC and WS-X6516A-GBIC Features (continued)

Feature	Description
Module upgrades available	
PoE support	Not supported.
Distributed forwarding support	Can be field-upgraded with either the WS-F6K-DFC, WS-F6K-DFC3B, or WS-F6K-DFC3BXL daughter cards. Refer to the *Catalyst 6500 Series DFC, DFC3A, DFC3B, and DFC3BXL Installation Note* for additional information and field upgrade procedures.
Pluggable transceivers support	GBIC transceivers are supported. Refer to your software release notes to determine which GBIC transceivers are supported. Refer to Appendix B for additional information on the GBIC transceivers.
Digital Optical Monitoring (DOM) support	Supported on some GBIC transceivers. **Note** Refer to your software release notes for specific information on which GBIC transceivers support DOM and the software release required for support.
Module front panel LEDs	**STATUS** • Green—All diagnostics pass; the module is operational. • Orange—The module is booting or running diagnostics; an overtemperature condition has occurred. **LINK** • Green—The port is active (the link is connected and operational). • Flashing orange—The port failed diagnostics and is disabled. • Orange—The port is disabled. • Red—The module is resetting; an overtemperature condition has occurred. **Note** If the module fails to download code and configuration information successfully during the initial reset, the LED stays red; the module does not come online. • Off—The port is not active or the link is not connected.

Table 2-45 WS-X6516-GBIC and WS-X6516A-GBIC Physical and Environmental Specifications

Item	Specification
Dimensions (H x W x D)	1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm). Occupies one slot in the chassis.
Weight	8.6 lb (3.9 kg)
Power requirement (at 42 VDC)	WS-X6516-GBIC (base module)—3.40 A WS-X6516A-GBIC (enhanced base module)—3.62 A
Environment	
Operating temperature	• Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (noncondensing)	10 to 90%
Operating altitude	• Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)

WS-X6724-SFP

The WS-X6724-SFP Ethernet module (Figure 2-21) provides 24 1-Gbps full- or half-duplex ports. Table 2-46 lists the module features, and Table 2-47 lists the module physical and environmental specifications.

Figure 2-21 WS-X6724-SFP Ethernet Module Front Panel

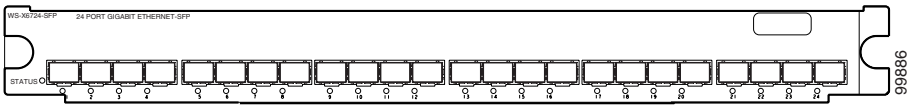


Table 2-46 WS-X6724-SFP Ethernet Module Features

Feature	Description
Ports per module	24
Connector type	LC (optical) or RJ-45 (copper)
Cabling distance	Depends on the SFP transceiver installed in the module port. Refer to Appendix B for descriptions of the SFP transceiver types and supported cabling distances.
Speed	1 Gbps
Buffer size	• Rx—166 kB per port • Tx—1.17 MB per port
Maximum frame size	Up to 9216 bytes per frame
Supervisor engine support	Supported by the Supervisor Engine 720 only.
Queues per port	• Tx—1p3q8t • Rx—1q8t **Note** Rx is 2q8t when using dCEF.
Chassis/slot restrictions	The module is not supported in the Catalyst 6503 chassis.
Bus connection	Connects to the switch fabric using a single 20-Gbps channel.
Module upgrades available	
PoE support	Not supported.
Distributed forwarding support	Ships with the WS-F6700-CFC daughter card factory-installed. The module can be upgraded in the field to support dCEF with the installation of a dCEF daughter card (WS-F6700-DFC3A, WS-F6700-DFC3B, or the WS-F6700-DFC3BXL). **Note** Refer to the *Catalyst 6500 Series CFC, DFC3A, DFC3B, and DFC3BXL Installation Note* for additional information and field upgrade procedures.
Pluggable transceivers support	SFP transceivers are supported. Refer to your software release notes to determine which SFP transceivers are supported. Refer to Appendix B for additional information on the SFP transceivers.

Table 2-46 WS-X6724-SFP Ethernet Module Features (continued)

Feature	Description
Digital Optical Monitoring (DOM) supported	Not supported.
Module front panel LEDs	**STATUS** • Green—All diagnostics pass; the module is operational. • Orange—The module is booting or running diagnostics; an overtemperature condition has occurred. **LINK** • Green—The port is active (the link is connected and operational). • Flashing orange—The port failed diagnostics and is disabled. • Orange—The port is disabled. • Red—The module is resetting; an overtemperature condition has occurred. **Note** If the module fails to download code and configuration information successfully during the initial reset, the LED stays red; the module does not come online. • Off—The port is not active or the link is not connected.

Table 2-47 WS-X6724-SFP Ethernet Module Physical and Environmental Specifications

Item	Specification
Dimensions (H x W x D)	1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm). Occupies one slot in the chassis.
Weight	Base module—8.8 lb (4.0 kg) Base module + DFC daughter card—9.4 lb (4.3 kg)
Power requirement (at 42 VDC)	• WS-X6724-SFP (base module)—2.23 A • Base module + CFC daughter card (WS-F6700-CFC)—2.98 A • Base module + DFC3A daughter card (WS-F6700-DFC3A)—5.23 A • Base module + DFC3B daughter card (WS-F6700-DFC3B)—4.93 A • Base module + DFC3BXL daughter card (WS-F6700-DFC3BXL)—5.53 A
Environment	
Operating temperature	• Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (noncondensing)	10 to 90%
Operating altitude	• Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)

WS-X6748-SFP

The WS-X6748-SFP Ethernet module (Figure 2-22) provides 48 1-Gbps full- or half-duplex ports. Table 2-48 lists the module features, and Table 2-48 lists the module physical and environmental specifications.

Figure 2-22 WS-X6748-SFP Switching Module Front Panel

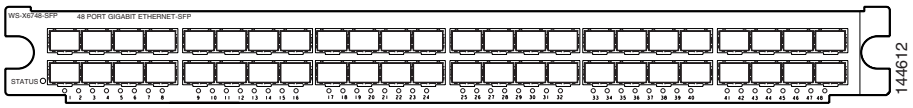


Table 2-48 WS-X6748-SFP Features

Feature	Description
Ports per module	48
Connector type	LC (optical) or RJ-45 (copper)
Cabling distance	Depends on the SFP transceiver installed in the module port. Refer to Appendix B for descriptions of the SFP transceiver types and supported cabling distances.
Speed	1 Gbps
Buffer size	Rx—166 kB per port Tx—1.17 MB per port
Maximum frame size	Up to 9216 bytes per frame
Supervisor engine support	Supported by the Supervisor Engine 720 only.
Queues per port	• Tx—1p3q8t • Rx—1q8t **Note** Rx is 2q8t when using dCEF.
Chassis/slot restrictions	Can occupy any slot in any Catalyst 6500 or Catalyst 6500-E chassis with the exception of the Catalyst 6513 chassis where the module can occupy only slots 9 through 13.
Bus connection	Connects to the switch fabric using dual 20-Gbps channels.

Table 2-48 WS-X6748-SFP Features (continued)

Feature	Description
Module upgrades available	
PoE support	Not supported.
Distributed forwarding support	Ships with the WS-F6700-CFC daughter card factory-installed. The module can be upgraded in the field to support dCEF with the installation of a dCEF daughter card (WS-F6700-DFC3A, WS-F6700-DFC3B, or the WS-F6700-DFC3BXL). **Note** Refer to the *Catalyst 6500 Series DFC3A, DFC3B, and DFC3BXL Installation Note* for additional information and field upgrade procedures.
Pluggable transceivers support	SFP transceivers are supported. Refer to your software release notes to determine which SFP transceivers are supported. Refer to Appendix B for additional information on the SFP transceivers.
Digital Optical Monitoring (DOM) support	Not supported.
Module front panel LEDs	**STATUS** • Green—All diagnostics pass; the module is operational. • Orange—The module is booting or running diagnostics; an overtemperature condition has occurred. **LINK** • Green—The port is active (the link is connected and operational). • Flashing orange—The port failed diagnostics and is disabled. • Orange—The port is disabled. • Red—The module is resetting; an overtemperature condition has occurred. **Note** If the module fails to download code and configuration information successfully during the initial reset, the LED stays red; the module does not come online. • Off—The port is not active or the link is not connected.

Table 2-49 WS-X6748-SFP Physical and Environmental Specifications

Item	Specification
Dimensions (H x W x D)	1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm). Occupies one slot in the chassis.
Weight	Base module with CFC daughter card (WS-F6700-CFC) installed—9.0 lb (4.1 kg) Base module with DFC daughter card WS-F6700-DFC installed—10.8 lb (4.5 kg)
Power requirement (at 42 VDC)	• WS-X6748-SFP (base module)—5.32 A • Base module + CFC daughter card WS-X6700-CFC)—6.07 A • Base module + DFC3A daughter card (WS-F6700-DFCA)—8.32 A • Base module + DFC3B daughter card (WS-F6700-DFC3B)—8.02 A • Base module + DFC3BXL daughter card (WS-F6700-DFC3BXL)—8.62 A
Environment	
Operating temperature	• Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (noncondensing)	10 to 90%
Operating altitude	• Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)

WS-X6816-GBIC

The WS-X6816-GBIC Ethernet module (Figure 2-23) provides 16 1-Gbps full- or half-duplex ports. Table 2-50 lists the module features, and Table 2-51 lists the module physical and environmental specifications.

Figure 2-23 WS-X6816-GBIC Switching Module Front Panel

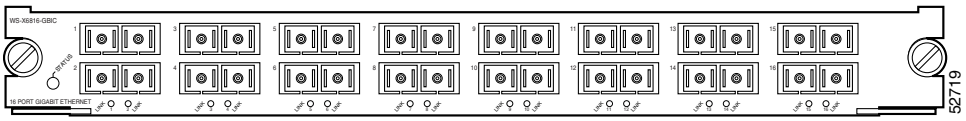


Table 2-50 WS-X6816-GBIC Ethernet Module Features

Feature	Description
Ports per module	16
Connector type	SC (optical) or RJ-45 (copper)
Cabling distance	Depends on the GBIC transceiver installed in the module port. Refer to Appendix B for supported GBIC transceiver types and cabling distances.
Speed	1 Gbps
Buffer size	• Tx—1.17 MB per port • Rx—166 kB per port
Maximum frame size	Up to 9216 bytes per frame
Supervisor engine support	Supported by the following supervisor engines: • Supervisor Engine 2 (requires a Switch Fabric Module or SFM2 be installed in the switch chassis and a DFC3 daughter card installed on the WS-X6816-GBIC) • Supervisor Engine 720 (requires a DFC3A, DFC3B, or DFC3BXL daughter card be installed on the module)
Queues per port	• Tx—1p2q2t • Rx—1p1q4t **Note** Rx is 2q8t when using dCEF.
Chassis/slot restrictions	Can occupy any slot in any Catalyst 6500 or Catalyst 6500-E chassis with the exception of the Catalyst 6513 chassis where the module can occupy only slots 9 through 13.
Bus connection	Connects to the switch fabric using dual 20-Gbps channels.

Table 2-50 WS-X6816-GBIC Ethernet Module Features (continued)

Feature	Description
Module upgrades available	
PoE support	Not supported.
Distributed forwarding support	Can be upgraded in the field to support dCEF with the installation of a DFC daughter card (WS-F6700-DFC3A, WS-F6700-DFC3B, or the WS-F6700-DFC3BXL). **Note** Refer to the *Catalyst 6500 Series DFC3A, DFC3B, and DFC3BXL Installation Note* for additional information and field upgrade procedures.
Pluggable transceivers support	GBIC transceivers are supported. Refer to your software release notes to determine which GBIC transceivers are supported. Refer to Appendix B for additional information on the GBIC transceivers.
Digital Optical Monitoring (DOM) support	Supported on some GBIC transceivers. **Note** Refer to your software release notes for specific information on which GBIC transceivers support DOM and the software release required for support.
Module front panel LEDs	**STATUS** • Green—All diagnostics pass; the module is operational. • Orange—The module is booting or running diagnostics; an overtemperature condition has occurred. **LINK** • Green—The port is active (the link is connected and operational). • Flashing orange—The port failed diagnostics and is disabled. • Orange—The port is disabled. • Red—The module is resetting; an overtemperature condition has occurred. **Note** If the module fails to download code and configuration information successfully during the initial reset, the LED stays red; the module does not come online. • Off—The port is not active or the link is not connected.

Table 2-51 WS-X6816-GBIC Physical and Environmental Specifications

Item	Specification
Dimensions (H x W x D)	1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm). Occupies one slot in the chassis.
Weight	Base module—9.2 lb (4.2 kg)
Power requirement (at 42 VDC)	• WS-X6816-GBIC (base module)—3.84 A • Base module + DFC daughter card (WS-F6K-DFC)—5.94 A • Base module + DFC daughter card (WS-F6K-DFC3B)—5.51 A • Base module + DFC daughter card (WS-F6K-DFC3BXL)—6.22 A
Environment	11.2 lb (5.08 kg)
Operating temperature	• Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (noncondensing)	10 to 90%
Operating altitude	• Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)

10-Gigabit Ethernet Modules

This section describes the following 10-Gigabit Ethernet modules:

- WS-X6704-10GE Ethernet Module, page 2-67
- WS-X6708-10G-3C and WS-X6708-10G-3CXL Ethernet Modules, page 2-70
- WS-X6716-10G-3C and WS-X6716-10G-3CXL Ethernet Modules, page 2-73

WS-X6704-10GE Ethernet Module

The WS-X6704-10GE Ethernet module (Figure 2-24) provides 4 10-Gbps full- or half-duplex ports. Table 2-52 lists the module features, and Table 2-53 lists the module physical and environmental specifications.

Figure 2-24 WS-X6704-10GE Ethernet Module Front Panel

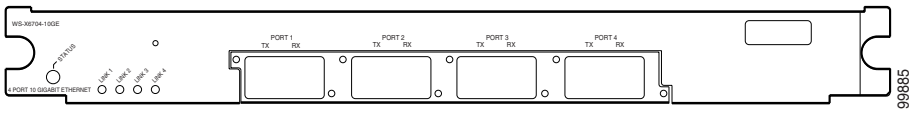


Table 2-52 WS-X6704-10GE Ethernet Module Features

Feature	Description
Ports per module	4
Connector type	SC or InfiniBand 4X depending on the type of XENPAK transceiver installed in the module.
Cabling distance	Depends on the XENPAK transceiver installed in the module port. Refer to Appendix B for supported XENPAK transceiver types and cabling distances.
Speed	10 Mbps
Buffer size	16 MB
Maximum frame size	Up to 9216 bytes
Supervisor engine support	Supported on the following supervisor engines: • Supervisor Engine 720
Queues per port	• Tx—1p7q8t (CoS to queue) • Rx—1q8t (when using dCEF); 8q8t (CoS to queue)
Chassis/slot restrictions	Not supported on the Catalyst 6503 chassis. Support on the Catalyst 6513 chassis is restricted to slots 9 through 13.
Bus connection	Dual 20-Gbps serial channel connections to the switch fabric.

Table 2-52 WS-X6704-10GE Ethernet Module Features (continued)

Feature	Description
Module upgrades available	
PoE support	Not supported.
Distributed forwarding support	Ships with the WS-F6700-CFC daughter card factory-installed. Can be upgraded in the field to support dCEF with the installation of a DFC daughter card (WS-F6700-DFC3A, WS-F6700-DFC3B, or the WS-F6700-DFC3BXL). **Note** Refer to the *Catalyst 6500 Series DFC3A, DFC3B, and DFC3BXL Installation Note* for additional information and field upgrade procedures.
Pluggable transceivers support	XENPAK transceivers are supported. Refer to your software release notes to determine which XENPAK transceivers are supported. Refer to Appendix B for additional information on the XENPAK transceivers.
Digital Optical Monitoring (DOM) support	Supported on some XENPAK transceivers. **Note** Refer to your software release notes for specific information on which XENPAK transceivers support DOM and the software release required for support.
Module front panel LEDs	**STATUS** • Green—All diagnostics pass; the module is operational. • Orange—The module is booting or running diagnostics; an overtemperature condition has occurred. **LINK** • Green—The port is active (the link is connected and operational). • Flashing orange—The port failed diagnostics and is disabled. • Orange—The port is disabled. • Red—The module is resetting; an overtemperature condition has occurred. **Note** If the module fails to download code and configuration information successfully during the initial reset, the LED stays red; the module does not come online. • Off—The port is not active or the link is not connected.

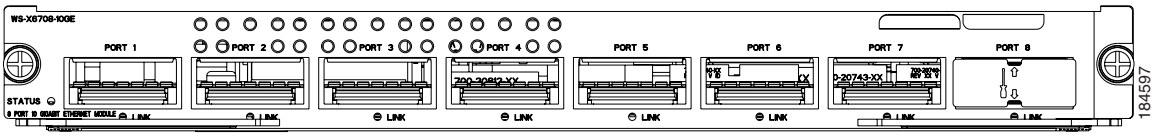
Table 2-53 WS-X6704-10GE Ethernet Module Specifications

Item	Specification
Dimensions	1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm). Occupies one slot in the chassis.
Weight	Base module + CFC daughter card (WS-F6700-CFC)—9.0 lb (4.08 kg)
Power requirement (at 42 VDC)	WS-X6704-10GE (base module + CFC daughter card)—7.03 A
Environment	
Operating temperature	• Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (noncondensing)	10 to 90%
Operating altitude	• Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)

WS-X6708-10G-3C and WS-X6708-10G-3CXL Ethernet Modules

The WS-X6708-10G-3C and WS-X6708-10G-3CXL Ethernet module (Figure 2-25) provides 8 10-Gbps full- or half-duplex ports. Table 2-52 lists the module features, and Table 2-53 lists the module physical and environmental specifications.

Figure 2-25 WS-X6708-10G-3C and WS-X6708-10G-3CXL Ethernet Module Front Panel



Note Both of the modules (WS-X6708-10G-3C and WS-X6708-10G-3CXL) are identified on the faceplate as WS-X6708-10GE.

Table 2-54 WS-X6708-10G-3C and WS-X6708-10G-3CXL Ethernet Module Features

Feature	Description
Ports per module	8
Connector type	SC or CX4 depending on the type of X2 transceiver installed in the module.
Cabling distance	Depends on the X2 transceiver installed in the module port. Refer to Appendix B for supported X2 transceiver types and cabling distances.
Speed	10 Mbps
Buffer size	128 MB per port
Maximum frame size	Up to 9216 bytes
Supervisor engine support	Supported on the following supervisor engines: • Supervisor Engine 720
Queues per port	• Tx—1p7q4t • Rx—8q4t
Chassis/slot restrictions	• Not supported in the Catalyst 6503 chassis. • Supported only in slots 9–13 in the Catalyst 6513 chassis. • When the WS-X6708-10G module is installed in a Catalyst 6500-E series chassis or a Catalyst 6500-NEB- A chassis, the configuration is NEBS 3 compliant (chassis supports operating temperatures up to 55°C). • When the WS-X6708-10G module is installed in a Catalyst 6500 non-E series chassis that is equipped with a fan tray 2 and a 2500 W or larger power supply, the configuration is not NEBS 3 compliant (chassis supports operating temperatures up to 40°C only).
Bus connection	Dual 20-Gbps serial channel connections to the switch fabric.

Table 2-54 WS-X6708-10G-3C and WS-X6708-10G-3CXL Ethernet Module Features (continued)

Feature	Description
Module upgrades available	
PoE support	Not supported.
Distributed forwarding support	• WS-X6708-10G-3C comes factory-equipped with a DFC3C daughter card. • WS-X6708-10G-3CXL comes factory-equipped with a DFC3CXL daughter card.
Pluggable transceivers support	X2 transceivers are supported. Not all types of X2 transceivers may be supported. Refer to your software release notes to determine which X2 transceivers are currently supported. Refer to Appendix B for additional information on the X2 transceivers. **Note** Only X2 transceivers with part number revision -02 or later are supported on this module. Check the part number label on the X2 transceiver to verify its usability.
Digital Optical Monitoring (DOM) support	Supported on some X2 transceivers. **Note** Refer to your software release notes for specific information on which X2 transceivers support DOM and the software release required for support.
Module front panel LEDs	**STATUS** • Green—All diagnostics pass; the module is operational. • Orange—The module is booting or running diagnostics; an overtemperature condition has occurred. **LINK** • Green—The port is active (the link is connected and operational). • Flashing orange—The port failed diagnostics and is disabled. • Orange—The port is disabled. • Red—The module is resetting; an overtemperature condition has occurred. **Note** If the module fails to download code and configuration information successfully during the initial reset, the LED stays red; the module does not come online. • Off—The port is not active or the link is not connected.

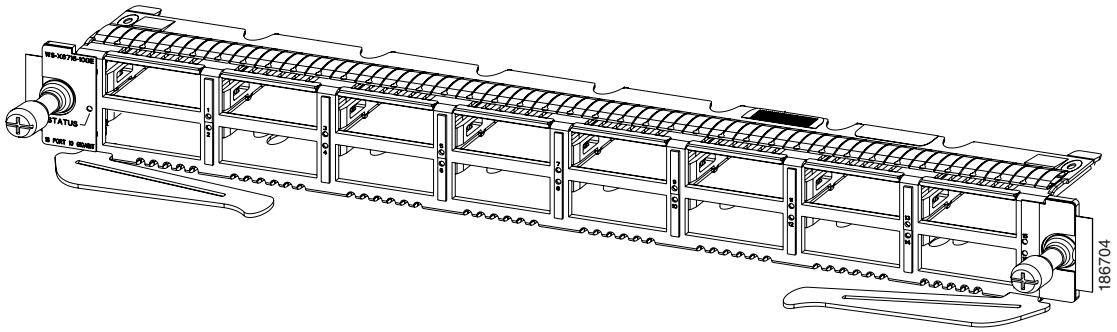
Table 2-55 WS-X6708-10G-3C and WS-X6708-10G-3CXL Ethernet Module Specifications

Item	Specification
Dimensions	1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm). Occupies one slot in the chassis.
Weight	16.0 lb (7.26 kg)
Power requirement (at 42 VDC)	WS-X6708-10G-3C (base module + the DFC3C daughter card)—10.58 A WS-X6708-10G-3CXL (base module + the DFC3CXL daughter card)—11.28 A
Environment	
Operating temperature	• Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (noncondensing)	10 to 90%
Operating altitude	• Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)

WS-X6716-10G-3C and WS-X6716-10G-3CXL Ethernet Modules

The WS-X6716-10G-3C and WS-X6716-10G-3CXL Ethernet modules (Figure 2-26) provide 16 10-Gbps full- or half-duplex ports. Table 2-56 lists the module features, and Table 2-57 lists the module physical and environmental specifications.

Figure 2-26 WS-X6716-10G-3C and WS-X6716-10G-3CXL Ethernet Module Front Panel



Note Both of the modules (WS-X6716-10G-3C and WS-X6716-10G-3CXL) are identified on the faceplate as WS-X6708-10GE.

Table 2-56 WS-X6716-10G-3C and WS-X6716-10G-3CXL Ethernet Module Features

Feature	Description
Ports per module	16
Connector type	SC or CX4 depending on the type of X2 transceiver installed in the module.
Cabling distance	Depends on the X2 transceiver installed in the module port. Refer to Appendix B for supported X2 transceiver types and cabling distances.
Speed	10 Mbps
Buffer size	Oversubscription mode—90 MB per port group Performance mode—200 MB per port
Maximum frame size	Up to 9216 bytes
Supervisor engine support	Supported on the following supervisor engines: • Supervisor Engine 720 • Supervisor Engine 720-10G
Queues per port	• Oversubscription mode: – Tx—1p7q4t per port group – Rx—1p7q2t per port • Performance mode: – Tx—1p7q4t per port – Rx—8q4t per port

Table 2-56 WS-X6716-10G-3C and WS-X6716-10G-3CXL Ethernet Module Features (continued)

Feature	Description
Chassis/slot restrictions	• Not supported in the Catalyst 6503 chassis. • Supported only in slots 9–13 in the Catalyst 6513 chassis. • When the WS-X6708-10G module is installed in a Catalyst 6500-E series chassis or a Catalyst 6509-NEB-A chassis, the configuration is NEBS 3 compliant (chassis supports operating temperatures up to 55°C). • When the WS-X6708-10G module is installed in a Catalyst 6500 non-E series chassis that is equipped with a fan tray 2 and a 2500 W or larger power supply, the configuration is not NEBS 3 compliant (chassis supports operating temperatures up to 40°C only).
Switch fabric connection	40-Gbps (80-Gbps full-duplex)
Oversubscription	4:1
Module upgrades available	
PoE support	Not supported.
Distributed forwarding support	• WS-X6716-10G-3C comes factory-equipped with a DFC3C daughter card. • WS-X6716-10G-3CXL comes factory-equipped with a DFC3CXL daughter card.
Pluggable transceivers support	X2 transceivers are supported. Not all types of X2 transceivers may be supported. Refer to your software release notes to determine which X2 transceivers are currently supported. Refer to Appendix B for additional information on the X2 transceivers. **Note** Only X2 transceivers with part number revision -02 or later are supported on this module. Check the part number label on the X2 transceiver to verify its usability.

Table 2-56 WS-X6716-10G-3C and WS-X6716-10G-3CXL Ethernet Module Features (continued)

Feature	Description
Digital Optical Monitoring (DOM) support	Supported on some X2 transceivers. **Note** Refer to your software release notes for specific information on which X2 transceivers support DOM and the software release required for support.
Module front panel LEDs	**STATUS** • Green—All diagnostics pass; the module is operational. • Orange—The module is booting or running diagnostics; an overtemperature condition has occurred. **LINK** • Green—The port is active (the link is connected and operational). • Flashing orange—The port failed diagnostics and is disabled. • Orange—The port is disabled. • Red—The module is resetting; an overtemperature condition has occurred. **Note** If the module fails to download code and configuration information successfully during the initial reset, the LED stays red; the module does not come online. • Off—The port is not active or the link is not connected.

Table 2-57 WS-X6716-10G-3C and WS-X6716-10G-3CXL Ethernet Module Specifications

Item	Specification
Dimensions	1.2 x 14.4 x 16 in. (3.0 x 35.6 x 40.6 cm). Occupies one slot in the chassis.
Weight	13.0 lb (kg) (Excludes weight of X2 transceivers)
Power requirement (at 42 VDC)	WS-X6716-10G-3C (base module + the DFC3C daughter card)—10.9 A WS-X6716-10G-3CXL (base module + the DFC3CXL daughter card)—11.6 A
Environment	
Operating temperature	• Certified for operation: 32° to 104°F (0° to 40°C) • Designed and tested for operation: 32° to 130°F (0° to 55°C)
Humidity (RH) ambient (noncondensing)	10 to 90%
Operating altitude	• Certified for operation: 0 to 6500 ft (0 to 2000 m) • Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)